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EDITORIAL

Plantation Crops. An average Indian peasant's interest in agriculture centres round the production of forage and food crops. Of late there is an incentive to grow industrial crops popularly known as money crops. But he is little acquainted with plantation crops nor has he the means to take them up. Some of them are of comparatively recent introduction in India; others are indigenous to India. They comprise crops like tea, coffee, rubber, cardamoms, and cinchona. Crops like tea, coffee, cardamoms and cinchona require a subtropical climate obtainable at higher elevations along the hill slopes which command good rain-fall and sunshine. Organised cultivation of these crops entails high capital expenditure in the initial stages. Probably the rigour of climate, lack of capital and specialized technique of cultivation must have stood in the way of the Indian taking to this type of cultivation. The production of these crops is mostly sponsored by Europeans, who are popularly known as the planters: they have been the pioneers in the line and have pushed up the cultivation in Nilgris, Mysore Malnad, Annamalais and the hill districts of Travancore and Cochin. Ever since Bababudan planted a few coffee seeds in Mysore in 1670 the area under the plantation crops had gone up steadily giving to-day a total of 79,000 acres of tea, 95,000 acres of coffee, 18,000 of rubber and 5000 of Cardamoms in the Madras Presidency, exclusive of those of the South Indian States.

These crops were remunerative till recent years; but now, due to over production in the world and other causes, there has been a general slump in prices. Restriction of production had to be imposed in the case of tea and rubber to keep the industry going. Of the planation crops, tea and cardamom alone are in a more fortunate position than the rest. In the case of cardamoms the home market continues to absorb the product, as the Indian is a lover of spices to the core and needs it for his domestic, social and religious purposes. For those who might feel interested in these types of crops, the Editorial Board has been able to secure contributions from competent sources, the first of which is published in this issue under the title "Tea Cultivation in South India" by Mr E. A. Stone of Gajamudi estate.

Some Useful Orchard Equipments Devised at the Fruit Research Station, Kodur.

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Introduction. Commercial fruit-growing is relatively a recent enterprise in this presidency as in the rest of India. Although fruits have been grown in this country from ancient times, the production has mainly been restricted in the past to small plots for making a variety of fruits available in all seasons for home consumption and in some cases to the urban centres. Large-scale or specialised orcharding is gradually coming to stay with the advancement of education and the rapid increase in the demand for fresh fruits particularly among the urban population. The increasing realisation of the valuable dietetic properties of fruits and the huge profits made by some of the pioneers in the field of fruit growing have stimulated the expansion of fruit industry, and as a result, the commercial culture of fruits is receiving considerable attention throughout this province.

Low production cost is the *sine quo non* of success in commercial fruit-growing. Labour charge is admittedly a heavy item in every orchard and nursery, and any implements devised to reduce the cost under this item or to increase efficiency are to be welcomed. The various equipments described in these pages have been devised with these above-mentioned objects in view.

I. GRAFTING POT STAND

Mango forms the leading fruit crop in this province, occupying roughly 250,000 acres. The major part of the activities of our nurserymen is at present devoted to the raising of mango grafts for sale to the public. The process of grafting known as inarching, is the only commercial method now employed in the propagation of mangoes. This process involves the raising of mango seedlings called, rootstocks and grafting these to shoots named scions from good bearing trees of the desired variety. As commonly practised, the inarching operation necessitates the erection of special wooden platforms or stands every season for placing the potted rootstock seedlings close to the scion shoots. In such cases, however, the scion shoots in the inner parts of the tree or in positions farther away from the platform or stand and do not become available for inarching. In some nurseries the pots are also tied to a strong branch of the scion parent tree close to the shoot intended for inarching. The practicability of this method depends on the nearness of the scion shoot to a strong limb. Considering the fact that several hundreds of mango varieties are grown in this province and the nurserymen are required to meet the orders for grafts of a very large number of varieties, it has become necessary to stock the nurserymens' gardens with a number of parent trees of all the numerous

reputed varieties. Any devise to increase the available number of scion shoots from a few parent trees will, therefore, lead to considerable economic benefit to the nurserymen.

In some nurseries near Chittoor and Salem, the practice of training the scion trees to a small manageable size and producing a large number of scion shoots close to the ground level is also widely prevalent. Apart from the trouble and expense involved in the training of the trees, this system leads to a loss of crop, which could have been obtained from the trees if they had been allowed to grow to their normal size. Furthermore, even under this system, a large number of shoots on the upper regions of the crown becomes unavailable for inarching unless special stands are erected for the purpose of bringing the potted rootstock seedlings close to such scion shoots. Another important reason which can be advanced against this system is that, the purchaser of the grafts has no chance to verify the variety, productivity, fruit quality etc. of the scion parent, because of the special training methods practised and the consequent non productive nature of the trees.

With a view to raise a much larger number of grafts from the scion parents than is possible by the prevalent methods and to reduce the recurring expenditure on the erection of platforms and stands or on tying the pots to the branches, a metal pot stand as shown in figure 1 was devised at the Fruit Research Station, Kodur. The stand consists of a metal ring which serves as a receptacle A to the pot, and this is connected by a horizontal adjustable rod B to another rod C having a clamp D at one extremity for securing the stand to the limb or to a wooden or bamboo post. A small rod connects B and C and aids in the adjustment of the stand according to the position of the scion shoot relative to the main limb or post.

The stand has been used for inarching plants *in situ* and for raising grafts with scions from full grown trees and has proved its efficacy in either case. It has also established its usefulness for 'top-working' trees to better varieties and for 'double-working'.

The cost of the stand, is however, a limiting factor in its becoming popular. Messrs. Shoranur Metal Works, who are manufacturing the stand, quote Rs. 22—8—0 for 12 or Rs. 2—0—0 each, ex-factory. As compared to this, the cost of erection of a platform or tying the pots to scion limbs works out roughly to a minimum of one anna and six pies respectively per graft per season. In view of the fact that these metal stands can be used over and over again for a number of years with no recurring cost excepting on bamboo posts when used for grafting low-hanging scion shoots, the extensive use of these stands in preference to the prevalent methods deserves consideration from the nurserymen. Where the scion parents are limited in number, these metal stands are bound to prove very helpful by rendering it possible to raise a much larger number of grafts than it would be possible otherwise.

II. NURSERY TRANSPLANTER

In a commercial nursery, the cost of labour on transplantation of seedlings and vegetatively propagated plants to nursery beds or pots forms a very important item. In citrus, the transplantation of seedlings is usually done once from seed to nursery beds and again to fresh nursery beds 4 to 6 months after budding for hardening the budlings. In mangoes, the seedlings have to be lifted from the beds and transferred to pots when inarching is to be practised. In the case of plants raised by cuttings, the rooted plants are usually lifted from the beds or pots after a period, depending upon the variety, and transferred to fresh pots or nursery beds. The transplanting operation has also to be carried out in the case of a large number of trees used for wind-breaks and in the case of some plants used for hedges.

The digging of pits in nursery beds and lifting of plants are, therefore, the two essential operations that are associated with transplantation in fruit nursery practice. The implements commonly used for carrying out these two operations are spades, *mamuties* or small hand tools consisting of a long handle with a flat or slightly curved blade of the type known as *dokudupara*. Sometimes in heavy soils, an ordinary or a pitting crowbar is also employed for digging pits ; but for lifting the plants, these implements and spades are of no value. Retaining a ball of earth intact around the roots of all our tropical fruits at the time of transplantation is essential; and this is usually achieved at present by the use of *Dokudupara* or a hand tool of similar design.

The nursery transplanter divised at the Fruit Research Station, Kodur, answers both the purposes of lifting of seedlings and young plants and digging of pits in nursery beds under certain soil conditions. It consists of a long circular blade of the shape and size of a 6″ to 12″ pot rivetted to a T shaped handle. The blade is provided with a longitudinal slit as is shown in figure II. It differs from the pitting crowbar devised by the Research Engineer, Coimbatore in having a tumbler-shaped blade and in being lighter in weight.

Six different types of transplanters with varying sized slits and blades have been devised and used to carry out extensive tests at the Fruit Reseach Station, Kodur during the past two years. These trials have revealed that the two transplanters shown in figure II are the most suitable for work in soils of light to medium texture. In heavy soils these transplanters cannot be worked satisfactorily. It has also to be pointed out that these implements cannot be employed in soils which are not previously worked to a reasonably fine tilth. Soils in seed and nursery beds have to be necessarily kept in good tilth, and it is only in such soils these tools have proved their efficacy.

For working this simple implement, no special instructions are necessary. For digging the pits, it is only necessary to push the tool down through the soil by using the necessary force through the hands and by

resting one foot of the operator on the upper edge of the circular blade. A few occasional twists of the hand in the manner of operating a steering wheel of a car is helpful in expediting the progress of the blade down into the soil. After the blade has reached the required depth, a slight twist is finally given to the handle and the tool is drawn out of the soil. While lifting the plants, the same process is employed, excepting that the plant intended to be lifted has to be passed through the slit at the outset and has to be kept in the centre of the circular patch of soil formed within the blade. After the transplanter is forced down and drawn out, the plant with the ball of earth around its root intact is pushed away gently from inside the blade. It is then ready for planting in the new pits dug out with the same tool in nursery beds or for potting.

The cost of medium sized transplanters (Vide A Fig. II) is quoted at Rs. 1—8—0 each and Rs. 32—0—0 for 25, ex-factory by Messrs. Shoranur Metal Works Ltd. The average cost of digging 100 pits in nursery beds in medium loam soil by the medium-sized transplanter works out to Rs. 0—1—4 as against Re. 0—3—2 by the *dokudupara,* while the cost of lifting citrus seedlings under similar conditions comes to Re. 0—1—7 and 0—3—8 respectively. An adult has been able to lift 250 plants or dig 300 pits by the above transplanter during 8 working hours, as compared to 110 plants and 120 pits respectively by *dokudupara*. It is thus clear that the transplanter has proved its usefulness and will, therefore, be a welcome addition to the equipments of our nurserymen having similar soil conditions as those referred to above.

III. PINEAPPLE "EYE" EXTRACTOR

The method of extracting 'eyes' from pine apples as practised at present consists of either scooping out 'eyes' from peeled fruits by means of pen-knife or slicing out thin linear portions of the flesh and the 'eyes' in a series of spiral grooves around the fruit. Both the methods are laborious, and in unskilled hands lead to a considerable loss of juice and flesh.

With a view to ensure the minimum loss of juice and flesh, and to effect a saving in time and facilitate a more convenient method of extraction of 'eyes'—the pineapple 'eye'—extractor was devised at the Fruit Research Station, Kodur, with considerable degree of success.

The instrument is very simple in design and works on the principle of forceps. Actual tests with this instrument in comparison with the method of eye-extraction with the pen-knife has shown that the extractor removes 100 'eyes' from Kew, Mauritius, Simhachalam and Queen varieties in 7.5, 5.0' 9.4 and 5.6 minutes respectively, as against 14,0, 12.5, 21.1 and 5.5 minutes respectively by pen-knife. The quantity of edible matter and juice wasted by employing the extractor is also very much less than by the use of pen-knife, it being on the average 5.0 ozs. per fruit in Kew, 2.0 ozs. for Mauritius by the former, as against 12.0 ozs. and 3.0 ozs. respectively by the latter. A thinner peel is required to be removed for use of the extractor

than for that of a pen-knife. Because of the fact that the fruit has to be handled for a shorter time, the extractor prevents too much bruising of the fruit and wastage of the juice. On the whole, the extractor does the work much more neatly and efficiently than a pen-knife, and, therefore, has proved its value not only for preparing the fruits for the table but also for the purpose of home-canning.

The extractor described above and shown in Fig. III-A has been found to remove the 'eyes' to a uniform depth only in skilled hands. For others, a blade with an adjustment to regulate the depth of insertion may be useful in order to reduce the loss of pulp and juice to the minimum. Since the size including the depth of the 'eyes' vary to a certain extent between varieties and to a small extent between individual fruits of the same variety, the value of regulating the depth of insertion will be felt both by the regular and casual users of the instrument. The extractor shown in Fig. III B answers this purpose. The improvement devised in this instrument lies in attaching an adjustable wing to each of the blades. These wings can be drawn in or slided down with the help of a screw moving through a slit as is shown in the figure. After extensively testing four instruments of different designs, the two described in these pages have been found to be the most suitable.

The cost of these extractors as quoted by Messrs. Shoranur Metal Works Ltd. is Rs. 2—8—0 for the first and Rs. 3—0—0 for the second instrument with the adjustable wing, ex-factory. Some reduction in cost is shown for orders for more than three instruments at a time. The instruments are made of stainless steel.

Summary. Three instruments, viz. *grafting pot stand*, nursery transplanter and pineapple 'eye' extractor have been recently devised and these have been found to be useful additions to the fruit-growers' equipments.

It is recognised that these instruments do not form, by any means, the last word in efficiency with regard to the various operations for which they are intended. The descriptions as given in these pages are not only intended to popularise these instruments but also to stimulate those interested in gardening to suggest or devise further improvements on the line, for which there may be some scope.

Acknowledgements. Sri. E K. Govindan Nambiar, Farm Manager, Taliparamba was responsible for suggesting the main improvements with regard to the nursery transplanter and for carrying out the trials in the early stages during his period of training at the Fruit Research Station, Kodur. All members of the staff of the Fruit Research Station, Kodur have also rendered help in designing and trial of all the instruments. The writer's thanks are due to all these officers of the Agricultural Department and also to the Imperial Council of Agricultural Research, under whose auspices this work was carried out.

Fig. I Grafting Pot Stand.
The method of using the stand of two different types on a bearing tree and of double-working *in situ* is also illustrated.

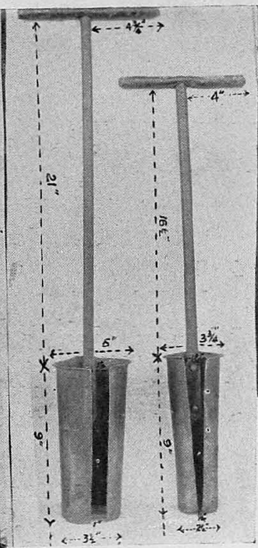


Fig. II.
A medium-sized and a mall 'Nursery Transplanter'.

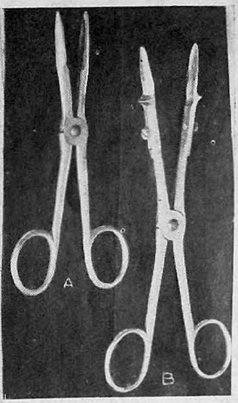
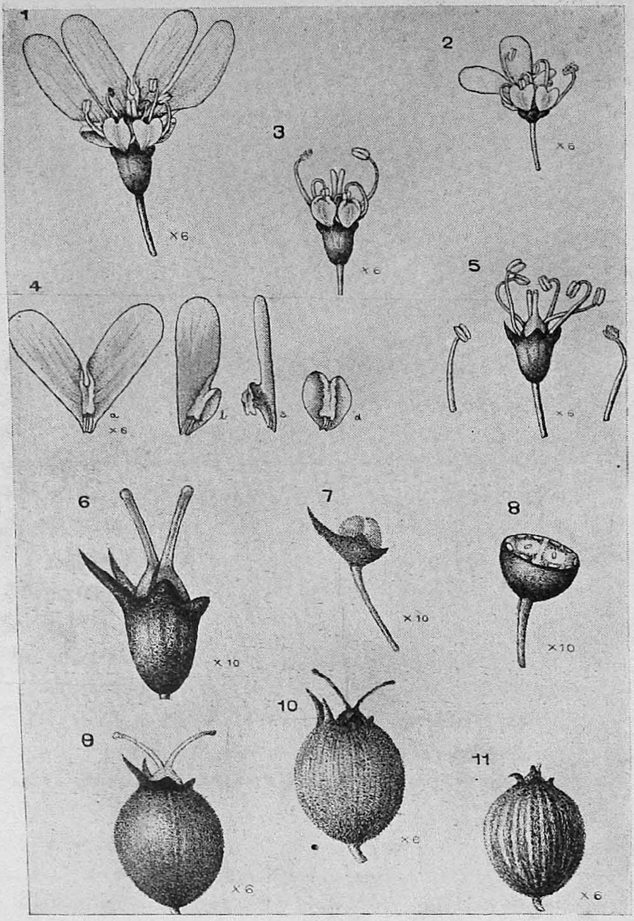


Fig. III.
A.—a pineapple "eye" extractor for use in skilled hands.
B.--an improved exra-ctor which regulates depth of insertion.



FLORAL PARTS OF CORIANDER

Fig. 1. Hermaphrodite flower.
Fig. 2. Male flower.
Fig. 3. Central hermaphrodite flower.
Fig. 4. (a) Two-winged petal with an incurved apical lobe.
(b) Single-winged petal with an incurved apical lobe.
(c) Non-winged petal with an incurved apical lobe.
(d) Petal showing the membranous ridge connecting the apical lobe.
Fig. 5. Pistil and five stamens.
Left—Anther dorsifixed.
Right—Anther dehisced.
Fig. 6. Pistil showing bifid nectary or stylopod.
Fig. 7. Bifid nectary in a male flower.
Fig. 8. Cross-section of an ovary.
Fig. 9. Young fruit.
Fig. 10. Ripe fruit with persistent styles and calyx.
Fig. 11. Dry fruit with persistent calyx.

Preliminary Studies in Coriander (*Coriandrum Sativum L.*)

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Introduction. Coriander is cultivated as a rainfed crop in almost all the black soil tracts of the Madras Presidency and it occupies an area of more than one hundred and twenty five thousand acres.

As this crop finds an important place in the system of cultivation of the black soil area in the Tinnevelly District, work was started in the Agricultural Research Station at Kovilpatti with the object of evolving a heavy yielding type of coriander. The method of its cultivation as practised in this district has been described by the author elsewhere (1937).

So far as the writer is aware, there is little information available on the floral mechanism of the coriander plant nor is there any record of any study on its anthesis. In the available literature, only a general description of the plant has been noted by various authors. This paper records an account of the observations on the anthesis of the plant.

Description of the Plant. As very many forms of coriander are grown in various parts of the world and since no description has been attempted to distinguish the South Indian type from others, a some-what detailed description is given here.

The form described, was derived from the local variety of coriander grown in the field and in pot cultures during the three years 1935—36 to 1937—38.

It is an annual herb with a characteristic aroma, varying in height from ½ to 2½ feet according to the type of soil, and climatic conditions. Its stem is round, striate, glabrous, usually light purple pigmented, though completely green types also occur occasionally. It is generally branched in the upper parts; first nodal branching does occur but it is rare.

Leaves, exstipulate, alterante, compound, petiolate with a sheath at the base, (petiole of the basal leaves 5 to 8 c. m. long and of the upper leaves 0·5 to 1 c. m. long;) basal leaves pinnate with broad leaflets, gradually turning bipinnate with narrow leaflets and finally becoming tripinnate towards the inflorescence with ultimate segments almost linear.

Inflorescence, a terminal compound umbel, stalked, the stalk being 6 to 40 c. m. long; very rarely subtended by a single bract 6 to 9 m. m. in length; an inflorescence is made up of 1 to 8 umbels, most frequently five. The umbel is subtended by an involucre of bracteole 4 to 7, green, linear unequal in size 1 to 5 m. m. long; it has a stalk 6 to 18 m. m. long. In each umbel both bisexual and unisexual flowers occur, the latter being in large numbers; an umbel comprises of 1 to 14 hermaphrodite flowers and 8 to 16 staminate flowers with an average of five of hermaphrodite and

eleven of staminate. The general type of umbel found in this variety can conveniently be divided into three regions, an outer-most whorl of four or five hermaphrodite flowers, a solitary hermaphrodite flower in the centre and thirdly a group of two or more whorls of male flowers between these two regions. In some umbels, two whorls of hermaphrodite flowers form the peripheral region. In a few cases male flowers occurred in the outer-most as well as in the innermost region, while in others, the whole umbel consisted of male flowers only, or undeveloped flowers with pistillode, or very minute incomplete flowers which shed soon.

The *Hermaphrodite flower*, this is pedicellate, the pedicel being 1½ to 3 m. m. long. In the central flowers it is always shorter having a length of about 0.5 to 1 m. m.

The *Calyx* is green, persistent gamosepalous, with five unequal tooth-like sepals 0·5 to1½ m. m. long; two teeth below the larger-winged petal are always longer than the rest.

The *Corolla* consists of five petals, free, white or lightly purple-tinged; in completely green types, petals are white; the petal has an incurved apical lobe which is slightly bifid at the tip (Fig. 4 a, b & c) and has a membranous midrib running from the base along the median line upto the point of curvature (Fig. 4 d). In the peripheral flowers three petals on the posterior side, possess usually wings in addition to the incurved apical lobe, the middle petal having generally two wings and the two adjoining ones one wing each (Figs. 1 & 4). These petal-wings are some-times unequal in size, radiating so as to give a characteristic and showy appearance to the umbel. The petals of the central flower do not develop as a rule any wing (Fig. 3).

Stamens are five in number, alternating with petals, filaments about 2 to 2½ m. m. long, anther light purple, two lobed, dorsifixed, dehiscing along longitudinal sutures (Fig. 5). Sterile anthers are generally yellow in colour but they do not ordinarily expand.

The *Ovary* is inferior and bilocular with a single ovule in each loculus (Fig. 8). On the top of the ovary is a green, bifid, fleshy, conical nectary termed as stylopod or stylopodium (J. S. Gamble 1919; Bentley and Trimen 1880; John Percival 1921) and from the top of this nectary arise two styles about 1 to 1½ m. m. long ending in a spherical stigma (Fig. 6). In odd instances, three styler arms were noted.

Staminate flowers, these are similar to hermaphrodite flowers in structure but smaller in size (Fig. 2); one or two petals in a few flowers only are drawn out into unequal wings. The flower is pedicellate, the pedicel being 1½ to 3½ m. m. long; ovary and styles are absent but the bifid nectary is present (Fig. 7).

Fruit. The ripe fruit is spherical in shape, smooth surfaced, light yellow with a light purple wash (Fig. 10). The dry fruit is a schizocarp, generally oval, four to six m. m. long and three to five m. m. wide. It has a brownish yellow colour and rough surface, marked with small longitudinal ribs, the

secondary ribs being slightly raised and more prominent than the primary ones; crowned by the persistent dry, brown, clayx-teeth (Fig. 11). The fruit does not readily dehisce but on slight pressure separates into two mericarps. The fruit emits an agreeable odour on rubbing.

Anthesis. In most of the flowers, the time of opening is not easily noticeable on account of the petals being incurved and non-spreading. Only in the case of flowers on the periphery which possess winged petals, the expansion of the wings is traceable. This is soon followed by the emergence of stamens. The time of flower-opening has, therefore, been reckoned from the emergence of the first stamen in a flower. The stamen emergence occurs in all flowers by the filaments elongating and pushing the anther out in between the two petals. The anthers emerge singly and very seldom two at a time. The time for all the five anthers in a flower to emerge, varies very widely depending upon the time of flower-opening or the emergence of first stamen. The data collected on this aspect are set out in Table I.

TABLE I. Interval for emergence of all stamens in a flower (from the first to the last stamen).

Emergence of first stamen (flower opening).	Emergence of last stamen. — same day. — forenoon (a. m.) 8	9	10	11	noon. 12	afternoon (p. m.) 1	2	3	4	5	6	7	next day. — forenoon (a. m.) 4	5	6	7	8	9	10	11	noon. 12	number of flowers observed.
5 a. m.	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
6 „	...	...	2	1	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
7 „	...	...	4	6	4	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	16
8 „	...	...	...	...	1	5	4	3	1	...	...	...	...	...	...	...	...	...	...	...	...	14
9 „	...	...	...	...	3	3	4	1	1	2	1	...	...	...	...	...	...	...	...	...	...	15
10 „	...	...	...	...	...	...	...	...	...	2	1	...	...	...	2	5	1	...	...	...	...	11
11 „	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	1	2	...	...	...	...	5
12 noon	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	4	5	3	1	...	...	16
1 p. m.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	1	...	...	...	4
2 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	...	...	...	6
3 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	2	...	1	...	6
4 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	...	...	...	4
5 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	2	2	1	6
6 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
																					Total	109

It will be seen from the above data that

(1) in the case of flowers that open up to 9 o' clock in the morning. the flower opening as indicated by the emergence of the last stamen is completed within the day itself.

(2) in the case of flowers that open later, the process is very much protracted, often extending upto noon on the following day

The above conditions are found alike both in hermaphodite and staminate flowers.

Anther Dehiscence. Anthers generally dehisce longitudinally within two to twenty four minutes after the expansion of the filaments. But in the case of stamens that emerge during the cool hours (4 A. M. to 7 A. M.) they open after one to two and a half hours. It takes one to six minutes for the completion of the dehiscence.

Developement of style and Stigma. At the time of emergence of the first anther in a flower, the two styler arms, each about half a millimeter in length remain close together with blunt tips, just above the level of the in-curved petals. They gradually elongate upto a length of one to one and a half millimeter above the stylopod and protrude about half to three fourths of a millimeter above the petals. Further these two styles which were quite close to each other, slowly diverge and develop the stigmatic nob at the tip manifesting the protandrous nature of the flower.

Pollination. The pollination is effected chiefly by wind and to some extent by insects like bees and flies. It was interesting to observe that when single flowers were covered with tissue paper bags, no fruits set, while enclosing a number of flowers in a bag, gave upto 33% setting. It was also found that covering entire plants with bags of muslin, tended to reduce the yield. (Table II).

TABLE II. Yield of Coriander from bagged and non-bagged plants (1935—36).

	Mean yield per plant in grm.	Number of plants studied.
Bagged	5·65	41
Not bagged	13·25	41
Standard error of the difference in yield	0·81	

Progress of Flower Opening. For this purpose a group of inflorescences was chosen and the time of expansion of the first stamen was taken as the time of the opening of the flower. Counts of flowers opening every hour were taken separately for hermaphodite and male flowers in plants raised under rainfed and irrigated conditions during 1935-36 and 1936-37. The results are set out in Table III. From the Table III it is seen that

(1) the opening of the flower commences as early as 4 a. m. and continues upto 9 p. m. and sometimes extends even upto 10 p. m. both in the case of hermaphrodite and staminate flowers.

(2) The opening is at its maximum between 8 a. m. and 12 noon.

(3) In the case of plants raised on black soil under rainfed conditions, the hermaphodite flowers open at a faster rate than the staminate. This is further confirmed by a different set of observation made (Vide Table IV)

Rate of flower-opening in hermaphrodite and staminate flowers. In an inflorescence, the hermaphrodite flower buds commence to open earlier than the staminate ones. The rate of opening of the two kinds of flowers is shown in Table IV.

TABLE III. Percentage of flowers opened during hourly intervals.

Season	Conditons under which crop grown.	(Forenoon).								Noon	(Afternoon)										Number of flowers observed.
		4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	
(a) *Hermaphrodite flowers.*																					
1935—36	Black soil rainfed.	0·6	...	0·9	1·7	14·4	17·0	17·0	11·8	11·5	5·2	6·0	3·7	5·5	1·7	0·6	1·2	0·6	0·3	0·3	347
,,	Red soil irrigated	...	0·4	3·6	8·1	12·6	20·7	10·4	10·4	7·2	6·8	7·7	5·0	2·2	3·1	1·8	...	...	...	...	222
1936—37	Black soil rainfed.	0·3	0·6	4·3	5·5	16·1	16·8	11·0	11·6	7·3	8·8	5·8	2·7	3·7	3·7	0·9	0·9	...	...	...	328
,,	Pot culture irrigated.	...	...	4·3	11·2	6·9	16·0	11·2	10·8	10·3	9·5	3·9	6·0	3·0	3·9	2·2	0·4	..	0·4	...	232
(b) *Staminate flowers.*																					
1935—36	Black soil rainfed.	...	...	...	2·2	8·0	11·2	18·9	9·6	12·9	9·1	8·5	5·8	5·8	3·8	2·9	1·1	...	...	0·2	449
,,	Red soil irrigated.	...	0·2	2·9	7·2	10·8	13·7	15·9	13·9	8·5	7·9	5·9	4·3	3·2	4·0	0·9	0·7	...	...	...	555
1936—37	Black soil rainfed.	0·1	0·3	...	1·6	2·9	21·8	15·6	13·0	8·4	14·4	6·0	5·3	5·6	2·6	1·0	0·7	0·6	0·1	...	694
,,	Pot culture irrigated.	0·6	0·6	3·9	3·0	10·0	11·5	17·7	12·4	8·6	8·5	7·9	5·3	2·8	3·6	1·7	0·7	0·6	0·6	...	531

TABLE IV. Comparison of the rate of flower-opening between hermaphrodite and staminate flowers in an inflorescence

Season.	Conditions under which crop is grown.	Kind of flowers.	Percentage of flowers opened per inflorescence per day.						Actual number observed.	
			1st day.	2nd day	3rd day.	4th day.	5th day.	6th day.	flowers.	inflorescence.
1935—36	Black soil rainfed.	Hermaphrodite	14·7	38·1	30·3	16·9	...	...	224	6
		Staminate	...	2·3	22·2	50·2	25·3	...	391	8
1935—36	Red soil irrigated.	Hermaphrodite	21·5	47·9	26·1	4·6	...	...	242	8
		Staminate	...	6·4	39·6	38·8	14·6	0·7	565	
1936—37	Black soil rainfed.	Hermaphrodite	25·0	43·2	23·5	8·0	0·4	...	370	14
		Staminate	0·2	8·6	37·3	41·2	12·7	...	702	
1936—37	Pot culture irrigated.	Hermaphrodite	42·9	36·9	16·3	3·9	...	...	284	14
		Staminate	1·0	23·4	45·5	28·0	2·2	...	581	

Summary. Detailed observations were made on the floral parts of coriander grown at the Agricultural Research Station at Kovilpatti.

The inflorescence is a terminal compound umbel, made up of one to eight umbels, most frequently five. The flowers are arranged in whorls and both hermaphrodite and staminate flowers occur in the same umbel.

The flower-opening commences as early as 4 a. m. and continues upto 9. p. m. with an active period of blooming between 8 a. m. and 12 noon. In an inflorescence, hermaphrodite flowers in general open earlier than the male flowers which start opening about a day later and take a day longer to finish.

The flower exhibits a wide variation in the interval for stamen-emergence and anther-dehiscence. In the case of flowers that open upto 9 o' clock in the morning, the anthesis is complete within the day itself, the interval varying from three to nine hours. But in the case of those that open later, the interval extends upto twenty two hours.

The anthers dehisce only after sun-rise, the active period of dehiscence being from 8 a. m. to 12 noon.

Acknowledgment. My thanks are due to Sri. R. Chockalingam Pillai, L. Ag., Superintendent, Agricultural Research Station, Koilpatti, for facilities afforded and valuable guidance given in preparing this paper.

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The Use of the Digging Fork for the Eradication of Hariali (*Cynodan dactylon*).

By M. KALIMUTHU, B. Sc. (Ag.),

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"Hariali grass (Tamil: *Arugam Pullu*) is the enemy of the black soil and the ryot who neglects it is the man to whom money should be advanced on the security of his fields, soon the mortgage will be fore closed upon and the land will change hands" says Mr. H. R. Pate, I. C. S. in the Madras District Gazetters, Tinnevelly. *Hariali* (Cynodan dactylon) is a common weed in cultivated lands and it is especially so in the black soils of Madura, Ramnad and Tinnevelly Districts. It is a weed very difficult to eradicate on account of its perennial mode of life and resistance to drought conditions. Its presence in cultivated fields is an unmistakable menace to the economic welfare of the ryots as it involves considerable amount of money, time and labour for eradicating the same. Hence the object of this short note is to show to the public the uses of a digging fork and how it has been successfully introduced by the Madras Agricultural Department in the black soil tract for eradicating this pernicious weed replacing the local implements hitherto used for the same purpose.

Before proceeding to describe the use of the digging fork for digging out *hariali*, a short description of the harm done by weeds to cultivated crops will not be out of place. In the matter of raising a good crop one of the foremost problems that confronts the ryots is the problem of controlling and eradicating weeds. In cultivated fields the loss due to an undesirable growth of weeds is enormous. The object of clean cultivation is to secure good produce and to avoid weeds. Weeds rob the young crop of its plant food, the energy of sun light and when allowed to grow up, they smother the crop to such an extent that the yield becomes poor and unsatisfactory. They may harbour insect pests, fungus diseases and bacteria which levy a heavy toll upon the crop. The market value of the land also goes down when infested with weeds as their presence involves considerable amount of money for their control and eradication.

The ryot, ignorant as he is of the history of the life of weeds, struggles against them with unsuitable implements. He is ignorant of the old adage that 'one year's seed is seven years' weed'. Annuals and biennials can be eradicated by simply cutting off the tops before seeding, but in the case of perennials we have to go still further and do the needful in time. The perennial weed, *hariali*, is so very hardy and resists drought so much that all attempts of the ryots with the local implements have not given the desired amount of success consistent with the amount of money, time and labour spent on it. The country plough cuts a V shaped furrow by the first ploughing leaving a wedge shaped unploughed portions of the soil and by the second and subsequent ploughings pyramid shaped unploughed

portions of the soil are left thus giving room for the subterranean branches and roots of the weed to persist. No doubt there is the iron plough which leaves no portion of the soil unturned but this weed has a net work of subterranean branches and roots spread to depths which the share point of an improved plough cannot tackle. The other local implements used for digging out *hariali* are the crow bar and a type of implement locally known as *vachath* after the model of a pick axe. In some tracts the *vachath* is used while in other tracts crow bars are more common.

Generally *hariali* digging is done in black soils in the dry season from March to April till about the close of August and is discontinued with the receipt of monsoon rains. It is done in fields where the cereals have been harvested and where the soil is cracked so that big clods of soil containing the subterranean branches and roots of *hariali* can be turned easily. While digging out *hariali* the ryots usually work in pairs one man handling the local crow bar or *vachath* and the other man working with a *mamooty*. Clods of soil containing the subterranean roots and branches are dragged out by the other man with the *mamooty* and exposed to the sun. Thus the roots and branches of *hariali* get dried up in the hot sun. Some clever ryots grow fodder cholam in a field infested with *hariali* and thus bring the roots and branches of the grass to the top layers of the soil, where they are easily tackled.

It will be interesting to know that as a result of departmental propaganda, digging forks have been successfully introduced for digging out *hariali*. There are now about 280 digging forks in 60 villages for digging out *hariali* and the time honoured local implements, crow-bar and *vachath*, are being replaced with digging forks. It has become so very popular in these villages that it is no more considered a foreign product and it is now a part and parcel of the equipment of a ryot in their villages. With the advantages of saving time, labour and capital, the digging forks relieve the ryots of a great amount of strain in fighting out a formidable foe, the *hariali* weed. Those who do not have digging forks of their own borrow them from others at a nominal hire of six pies to one anna per day People who own no lands and make a living as agricultural labourers have all replaced their local implements with digging forks, for they find that there is no demand for labour handling the local implements. In villages where the use of this implement is not yet known coolies from other villages who can successfully handle the digging forks are engaged for digging out *hariali*. Women coolies are very often engaged as partners to handle the mamooty. There are some women who can even successfully handle the digging fork. Some times we see a man and his wife working together, the former handling the digging fork and the latter the mamooty. The prongs of the digging fork are forced into the soil with the foot and big clods of soil with the *hariali* roots and branches are levered up. The clods of soil thus dug up are broken by two men with their mamooties and thrown aside. Thus the weed gets dried up in the hot sun.

Regarding the economics of the use of the digging fork in preference to the local implements, the former possesses several advantages over the latter. The digging fork with a D shaped handle or a T shaped handle is lighter and is easily lifted and pressed into the soil by foot using the weight of the worker. Thus it easily gets in and a greater volume of soil with the roots and branches of *hariali* is disturbed. When digging is done with the help of the local implements the ryots work in pairs one man handling the local digging implement and another assisting him with his *mamooty*. But in the case of the digging fork two men with their mamooties can assist a single man handling the digging fork This shows beyond doubt the rapidity and ease with which digging of *hariali* is done with digging forks. Three men with one digging fork and two mamooties turn out as much work as four men using two crow bars or *vachaths* and two mamooties. It is also found that to dig an acre infested with *hariali* to a depth of a foot and a half with digging forks, 90 men are required; but when the local implements are used 120 men are required. Formerly the man handling the digging fork used to get wages up to 8 annas a day; but now due to the economic depression and the large use of the implement by a good number of ryots he gets only 5 annas a day and his partner gets 4 annas a day. The man handling the local implement also gets 4 annas a day. Calculating at these rates it is seen that to dig out one acre with digging forks it costs Rs. 24—6—0 while it costs Rs. 30—0—0 an acre to dig with local implements. Besides the work turned out with the digging fork is more efficient as there is less chance of the weed remaining undisturbed.

Thus it is seen that the ryots have understood the great advantages of using digging forks over the local implements. Due to the strenuous propaganda carried on by the department for distributing the implements far and wide, the demand for them is ever on the increase. Demonstrations, are conducted in the black soil villages during the *hariali* digging season and the procedure of digging out *hariali* and the advantages of using such implements are explained to the ryots with good results. The fork is also now an important item in the equipment of the depot of an Agricultural Demonstrator. A very large number of digging forks was distributed in recent years through departmental help. To such of those who are unable to make immediate payments *takkavi* loans have been granted by the department for purchasing digging forks. They are now most popularly used in two taluks of Aruppukottai in Ramnad District and Kovilpatti in Tinnevelly District. In the village of Puliampatti in Aruppukottai Taluq there are now about 100 digging forks and about 40 at Idaiseval in Koilpatti Taluq. In either of these villages, the local implements have practically been ousted and the ryots are now using only forks for digging out *hariali*.

Very recently it has come to the notice of the Department that the implements available now are not good and that the prongs have a tendency to bend. The quality and efficiency of the digging forks depend entirely upon the strength of the prongs and if one or two prongs get bent

the implement cannot be used further for digging out *hariali.* But the department has already taken up the question and the defects shall be rectified through the Research Engineer, Coimbatore and the ryots will have better digging forks as in the early years.

Besides its use for digging out *hariali,* the fork is a very valuable implement for other agricultural operations such as digging manure pits, digging out litter from trenches and manure from pits, intercultivating sugarcane and plantains and trimming bunds in cultivated fields. It has been successfully demonstrated for harvesting root crops like potatoes, sweet potato and yams. It is also a valuable horticultural implement and can be used to stir the soil in fruit gardens and to dig pits to plant seedlings and grafts. It is also popularly used to uproot unwanted and undesirable plants in fields and gardens. It is quite useful for non-agricultural operations such as excavations for foundations of buildings, digging wells, digging out silt in tank-beds, deepening tanks, and for a variety of other purposes.

I feel extremely thankful to Mr. A. Gopalan Nayar, Assistant Director of Agriculture, Tinnevelly who besides taking a keen interest in popularising this implement gave me all facilities to prepare this paper.

Tea Cultivation in South India.

By E. A. STONE

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Introduction. While accepting an invitation to write a few articles on tea cultivation for the *Madras Agricultural Journal,* the writer wishes to make it quite clear that these articles will be simple and elementary. There are many planters and scientists who will be able to write more detailed and learned articles should these be desired.

The tea plant (*Camellia Thea* Link) belongs to the family Ternstroemiaceae and is an evergreen requiring humid conditions for its growth. Provided the rainfall is spread out over the year it can manage on as little as 50 or 60 inches a year. In South India where the rainfall in the plains is well below that figure and is not spread over the year, tea flourishes only in the hills, especially in those hills where a heavy South west monsoon rainfall is usual. In the Shevaroys and parts of Mysore the rainfall is insufficient for tea, and coffee flourishes better; but in the Anamallais and High ranges which are further west and get the South West monsoon rains, tea does well.

Varieties and distribution. There are various varieties of tea grown in South India varying from the broad leaf Assam types to the China and China hybrid types. The broad leaf types are more tender and less able to stand extremes of cold and drought, and are therefore planted at altitudes

under 5,000 feet. In the High Ranges and Nilgiris where tea is grown up to 7,500 feet, the China varieties are used at the higher elevations. The leaves of these varieties are much smaller and tougher and possess a much thicker epidermis than the Assam types and are able to withstand frosty nights.

Hybrid varieties do not seem to do well and give poor crop. For this reason tea grown for seed must be situated several miles away from any other tea to avoid the risk of cross pollination. Excepting one or two small experimental areas tea is not cultivated for seed in South India. Seed is mostly bought from Assam, and is known by the name of the estate or district from which it comes – Rajghur, Jaipur, Betjan etc. For purposes of transport the seed is packed in powdered charcoal in half maund boxes. The number of seeds to a maund varies a good deal, but is somewhere about 15,000 or 16,000. The average tea seed is round, and a little over ½" in diameter being enclosed in a tough brown outer 'shell'.

NURSERY MAKING

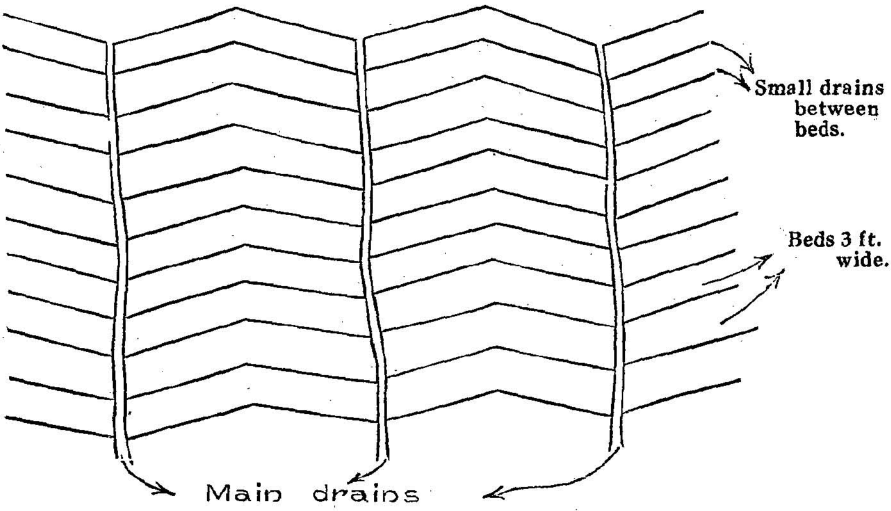
As soon as the seed arrives it is taken out of the boxes, washed and put out in germinating beds. These are simply beds of sand of a convenient width, and about 3 inches deep. The seeds are spread out one seed thick and then covered with another inch or so of sand. The beds are kept damp by daily watering and are well shaded by overhead *pandals*. Every 5 or 6 days the seeds are picked over and those which are starting to germinate are removed for planting out into nursery beds. The beginning of germination is heralded by the cracking of the brown outer cover, the crack being plainly visible when the covering sand has been brushed away. It is for this reason that sand is used, as it does not adhere to the seed as earth would, so masking the crack.

Sometimes the damp seed in the germinating bed is attacked by a slimy white fungal growth. It is therefore advisable to dip the ungerminated seed in a fungicide like a weak solution of copper sulphate before putting them back in the bed after each sorting.

Another pest which attacks the seed and young tea plant root is the eel worm' (*Heterodera marioni*). This parasite is invisible to the naked eye but plainly visible under the low power of the microscope. It is found in sour water-logged ground, and for this reason neither germinating beds nor nursery beds should be made in such situations, nor should they be over-watered, as this encourages the growth of eel-worm and fungal parasites. There are two ways of making the nurseries into which the germinated seed is planted.

(i) *Stump nurseries.* These are made in a convenient jungle area, facing east if possible, but any way sheltered from the west for two reasons: (a) to get the morning but not the evening sun and (b) to be sheltered from the heavy S. West monsoon squalls. The site must also be near an adequate water supply which will not dry up in the dry weather. The undergrowth and small trees are first cleared, and the ground dug about

two feet deep, every stone and root being removed. This is essential if twisted roots on the young tea plants are to be avoided and the easiest way to do it is to start at the bottom of the slope in the site and work upwards. (N. B. What little flat ground there is in the tea-growing hills is sure to get water logged in the wet weather and should not be chosen for nursery sites.) Next the beds are put in in such a way as to provide for the proper draining of the ground during heavy rains. Main drains are put down the hollows and the beds slope up from these on either side having a small drain about a foot wide and 4 or 5 inches deep between each bed. A bed should not be more than 3 or 3½ feet wide to allow labourers to walk round the beds to weed them and clear rubbish without treading on them. The final effect is similar to a number of herring bones placed side by side. (See diagram below).



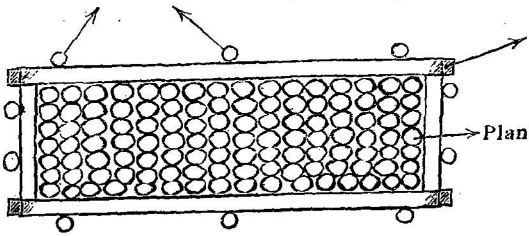
Herring-bone pattern of nursery beds.

The germinated seed is planted out in the beds 4 to 6 inches apart, the easiest method is to use a planting board with holes drilled through it at the required intervals. This is placed over the bed and a stick pushed through each hole to mark the correct spacing. The seed when planted should be only just covered with earth; if planted too deeply growth is retarded. It should also be planted the right way up, i- e., with the flat end downwards. One side of a tea seed is always slightly flat and it is on this side that the radicle invariably appears.

The nursery is shaded by the large trees which have been left when clearing, and a nicely dappled shade is ideal. In the rainy weather the drip from these tall trees damages the beds, and these should be continually earthed over with good jungle soil. It is also advisable to pave the main drains with large stone, as otherwise the passage of water scours them deeper and deeper until the ends of the adjoining beds fall in.

Seed is usually obtained in November, germinates and is planted out throughout December and part of January. Until the hotweather rains fall in April the nurseries have to be watered. At first it is necessary to water the beds every other day, but later when the plants are growing well it is advisable to cut down the watering to every third and fourth day. This allows the top soil to dry out periodically and encourages the formation of a good tap root.

(ii) *Basket nurseries.* In this type of nursery the ground is not dry. The beds are made up of baskets full of tightly packed sifted jungle soil, placed close together and kept in position by laying small tree trunks or branches along the edges of the beds (see diagram below).



Surface view of one bed.

Each basket is 9 "to a foot long and 5" or so wide so as to allow 3 or 4 months growth for the small tea plant. A *pandal* is erected over the beds for shading and watering and other items of attention are similar to those given to stump nurseries, except that basket nurseries tend to dry more quickly, and so need watering somewhat oftener. Basket nurseries cost more to make i. e. the cost per thousand plants when ready for planting out is higher than is the case with the stump or jungle nursery. The relative merits of the two kinds will be discussed in my next article which will deal with planting out in the clearing.

(To be continued).

SELECTED ARTICLE

Cardamoms

By W. MOLEGODE

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The cardamoms of commerce are the seeds of the herbaceous perennial *Elettaria cardamomum* of which three varieties are found in Ceylon. One of these is indigenous to Ceylon and grows wild in the wet forests in the higher elevations, chiefly in the Ratnapura and Lunugala districts. The cultivated varieties, Malabar and Mysore, appear to have been introduced from India. These two varieties are easily distinguishable by the characteristics noted below.

Malabar—leaves silky on the under surface; racemes arise from the base of the stem and creep on the surface of the ground around the clumps; fruits or capsules angled shorter and more globular than the Mysore type.

Mysore—Leaves larger with a coarser under surface not silky but hard and smooth; racemes rise erect; fruits oblong and larger than those of the Malabar type.

The two varieties differ slightly in flavour.

In Ceylon at the present time, about 7,000 acres are under cultivation. Of this area about 1,000 acres consist of small holdings up to 2 acres in extent belonging to the village population. The rest are plantations belonging to Estate companies and to individual planters, both European and Ceylonese. Estate scale plantations vary from 5 to 450 acres in extent, the latter figure representing probably the largest cardamom plantation in the Island. There are several plantations of over 100 acres each, and two or three between 200 and 300 acres. Cardamoms are cultivated in Ceylon only in the higher, moist elevations.

The quantities of cardamoms exported during the last five years and their value are noted below. It will be observed that the prices have varied considerably.

	Quantity in Cwts.	Value in Rupees.
1933	3,161	338,096
1934	3,441	355,960
1935	2,362	274,751
1936	2,335	425,907
1937	2,890	685,736

Cardamoms are grown very extensively in Mysore and the cultivation of the crop has been started in Sumatra.

The world's requirements of cardamoms appear to be limited, and question naturally arises: is it advisable to extend the cultivation of cardamoms?

The chief use of cardamoms is as a spice. In the East cardamoms are used extensively as a masticatory and, particularly in India, as an aphrodisiac. They are also used medicinally as an aromatic, stimulant and diuretic. On the continent of Europe, the capsules are crushed and mixed with flour and baked into bread noted for its warmth-giving properties.

Elevation and rainfall for cardamoms. Elevation and rainfall are important factors for the successful cultivation of cardamoms. The elevation best suited for the Malabar variety is between 2,000 and 3,500 feet above sea level and for the Mysore variety between 3,000 and 4,500 feet, with a well distributed rainfall between 120 and 150 inches per year. It would be a venturesome proposition to grow cardamoms for commerce at lower or higher elevations than these.

Soil and situation. Well-drained, fairly deep, moist, rich loamy soils such as are found under high forests on undulating situations are the most suitable. Cardamoms will thrive best on such soils under light natural shade and when protected from strong wind. The sloping high hills of Medamahanuwara, Knuckles, Rangala, Kotmale, Dolosbage and Balangoda have some of the best plantations.

A stiff clayey soil which remains excessively wet and a light or sandy, rapidly drying soil are unsuitable. The areas truly satisfactory for cardamoms are limited in Ceylon and it is probable that very little more land could be cultivated successfully with the crop.

Propagating and planting. Though propagation can be effected by seed. It is generally done by division of the crown of rhizomes, or "bulbs" as they are called. Bulbs for planting have to be carefully selected. They should be 18 months to two years old, and should contain at least two growing stems. Any damaged bulbs should be rejected and bulbs for planting should not be kept in the open for more than a few days after lifting.

It is not uncommon to plant entire plants separated from old clumps. If this method of propagation is adopted, care is necessary to see that each plant has its proper proportion of rhizomes to put forth new stems.

The most suitable distance for planting is 8 feet apart. Holes or pits for each bulb or plant should be prepared well ahead of planting: they should be 2 feet wide and 1 to 1½ feet deep and filled up with surface soil and allowed to "weather" for 2 or 3 weeks. Too deep or shallow planting of bulbs results in casualties. The bulbs should be buried up to their collars and the soil pressed down firmly with the hands.

Where bulbs are difficult to obtain, propagation by seed is recommended. Fruits from which the seed for growing is intended, should be selected. They should have attained full maturity. Seeds which are compact and adhering in a mass should be air-dried and separated, soaked in water for two hours and sown in a well prepared nursery bed. The finer the texture of the nursery bed, the better it is. A better practice is to raise seedlings in boxes containing a good mixture of fine leaf mould and sand. The soil in the nursery or seed boxes should be kept damp and protected from excessive heat of the sun and, if in the open, protected from direct rain. In about a year the seedlings will have grown about a foot in height when they may be lifted carefully and planted out.

Seeds, as stated before, may take two or three months to germinate. At lower elevations it has been found that seeds germinate in less than a month. The germination is generally poor. It is, therefore, advisable to sow about 1 lb. of dry seed to raise enough seedlings to plant up one acre, although many more plants than the 600 required may be obtained from one pound of seed.

After cultivation. Very little after cultivation is required. weeding may be necessary at intervals for about two years after planting out at lower elevations and for about three years at higher elevations. Once the bushes are fully formed they will keep down weeds and an occasional weeding once in two months or so only is necessary. Dry leaves may be removed which should not be thrown away but put round the clumps. Decaying or any damaged leaf stalks must be carefully cut off leaving about 2 feet of stalk. Do not injure the root stock.

There is no local experience regarding manures suitable for cardamoms. Experiments have been made with artificials with no success. Experience has shown that it is best to let the leaves that fall on the clumps remain undisturbed except when rotting of the root stock is discovered.

Crop and Harvest. At lower elevations cardamoms usually come into bearing in two years and at higher elevations after the third year. The early crops are small. From about the fifth year full crops of 1,000 to 1,500 pounds of green cardamoms may be expected per acre, for some years. Heavier yields than these have often been obtained. At lower elevations, crops will begin to decline after about six years. At higher elevations good crops may be expected for about 10 years; the yield gradually falls off for the next ten years, after which a crop of 50 lb. per acre will be found to be the average.

Although flowering may occur all the year round, the main flowering season is from April to July and harvesting may begin in August and last up to December. The heaviest crops are gathered from October to December.

Fruits are borne in succession in the same racemes. It is therefore necessary to pick individual fruits very carefully as they mature by cutting them off with a pair of scissors without damaging the racemes bearing the blossom. From the flower to the mature fruit the period is about five months at higher elevations and about three to four months for lower elevations. Rounds of picking should be made once in three weeks to a month.

On ripening, cardamom fruits change their colour from green to a pale green. It is advisable to pick the fruits just before they fully ripen as over-ripe fruits are liable to split in curing.

Green Curing of Cardamoms. The old methods of curing cardamoms by bleaching are now being replaced, by progressive growers, by green curing which is superior in many ways. The old laborious procedure of sulphur smoking, sun-drying, soaking in water, sulphur smoking again and repeating these processes several times before a marketable commodity could be obtained, was not only expensive but required constant care and attention and depended largely upon weather conditions. Green curing is independent of the weather, requires less labour and a further advantage is that green cured cardamoms command a higher price.

Two methods of green curing are in use in Ceylon at the present time.

1. Drying in a heated chamber, the heat being generated by an external furnace and conducted through the chamber by means of flues.
2. Drying over an open charcoal fire in a closed chamber.

Either method gives equally satisfactory results. The open charcoal method is recommended as simpler, less expensive and therefore more capable of adoption by small holders.

In neither case is a solid chamber of brick and stone necessary. Walls of wattle and daub plastered and white-washed, or even of wooden planks are adequate. The chamber should be provided with a ceiling and the door should be close-fitting to conserve the heat. A window for the admission of light is desirable but not essential. In the case of chambers for the open charcoal firing method, ventilation is very necessary to carry off the fumes and should be provided.

A hot-air chamber may be a building with inside dimensions of 15 ft. by 15 ft. The ceiling is at the height of 8 feet. On two sides are racks for trays. The trays are of simple construction consisting of ordinary reeper frames with wire mesh or hessian bottoms. A convenient size for trays is 2 ft. 6 in. by 2 ft. 6 in., the racks being built to permit of easy admission and removal of the trays.

The racks are arranged in tiers being 8—9 inches apart.

Attached to the room is the furnace which is fed from outside. This may be 3 ft. by 3 ft. and 4 ft. high. From the furnace the hot air is carried along heating flues which lie a few inches above floor level, smoke escaping from the chimney.

This constitutes a complete hot-air curing barn and the space is sufficient for a crop of 4,000 to 4,500 lb. (dry weight) per annum. Outside the room is a store in which the dried or cured cardamoms are stored. Rat-proof boxes or bins are essential for storing cured cardamoms until they are ready for despatch.

The open fire chamber may be made in a building of any convenient size. Along two sides are firing places. The trays of cardamoms are placed at the top. The charcoal fire is lit within the chamber which should allow of admission of air. The room should be closed but ventilators should be provided to allow of the escape of fumes. Rack is provided for the reception of trays of cured cardamoms where they remain for some days to complete the curing or drying process.

Curing process. In curing by the hot-air process of flue curing, care must be exercised in regulating heat. Too rapid drying is unsuitable. The process may be explained as follows :—

When the cardamoms are harvested and brought in, they are placed in trays (a tray 2 ft. 6 in. by 2 ft. will accommodate 8—12 lb. of green cardamoms) the trays being then placed in the racks. The furnace is then fired. The consumption of firewood should be about ½ cubic yard of good hard firewood for every 1,000 lb. of green cardamoms. The cardamoms are allowed to dry for about 30 hours at a temperature of about 180°F. Occasionally the trays are withdrawn

and the cardamoms turned over. After about 12 hours of drying the bottom and the top trays are exchanged to enable the trays to receive the same degree of heat during process. When cured, the cardamoms should be hard and greenish in colour.

In the open fire method the cardamoms are spread on trays with a wire mesh bottom, and placed over a slow burning charcoal fire for about 12 hours. They are then transferred to trays with a jute hessian bottom and placed on a higher rack for another day. By this time the cardamoms should have dried sufficiently, but to ensure complete drying, the trays are removed to stand in the same room.

The fire is lit on the floor of the chamber, charcoal being piled into heaps of about 1½ ft. in height. Approximately one pound of charcoal is required to dry each pound of green cardamoms.

Clipping. The dried cardamoms require clipping before they are marketed in order to remove all stalks and calyces. The common method of clipping with scissors can be replaced quite efficiently by rubbing the dried cardamoms over a coarse surface of jute hessian or wire mesh. This can be done more satisfactorily while the cardamoms are still hot. For this purpose the dried cardamoms are further fired by placing them over the charcoal fire or hot air chamber, as the case may be, for about two hours and then rubbed on hessian or wire mesh surface.

Sorting. The next step is sorting. Sometimes a sieve with quarter inch mesh is employed for the purpose, but hand picking is more reliable. Damaged, shrivelled and very small capsules are removed for the extraction of seed. It might here be stated that the proper time for harvesting the crop is shortly before the capsules ripen. If allowed to ripen fully the capsules split and shed seeds in the process of drying.

Grading. The sorted cardamoms should be graded according to size and colour, being known in the trade as " Longs " " Mediums " and " Shorts ". Green cured cardamoms should be of an even greenish yellow colour. At no time during the drying process should they be exposed to any strong light which tends to bleach them and spoil the uniformity of colour.

Packing. For export, the cured cardamoms should be packed in aluminium and paper lined cases, taking about 112 lb. net, perferably in venesta cases.

The practice of packing cardamoms in double sacks, which is common in Ceylon, is to be deprecated owing to the danger of damage by rats.

General. The yield of cardamoms varies considerably with the age of the plantation, the nature of the soil and weather condition. Some plantations yield as much as 2,000 lb. of green cardamoms per acre in a good year. A yield of about 1,200 lb. is considered a good crop. The return of cured cardamoms is usually 25 to 28 per cent. of the green weight.

The prices of cured cardamoms have varied in the last three years between Rs. 1·05 and Rs. 2·10 per lb. (*The Tropical Agriculturist.* Vol. XCI. No. 6, Dec. 1938).

EXTRACTS

The Cashew (*Anacardium occidentale*). During very recent years the cashew has been creating a new interest, chiefly because of the nut which is finding its way into commerce. This tree is native to Brazil and possibly other parts of tropical America. It certainly became wide-spread on this continent and the West Indies at a very early date and for centuries past it has been growing in warm regions of the Eastern hemisphere also. By the native people of all these countries, it has been prized for the fleshy portion of its fruit and for the seed

which is very curiously placed outside of the flesh or, in common parlance, the "nut" which grows on the outside of the "fruit." As a fruit, the cashew is used in many ways in the countries where it is grown, including dessert, fruit-punch and an alcoholic drink. The fruit is very perishable and cannot be shipped long distances but finds its way to local markets in considerable quantities. It is the seed or nut, however, which in recent years has been bringing the cashew into prominence The cashew nut has always been appreciated in the countries where the tree grows but it is only recently that it has found its way into world commerce. This new development appears to have been due largely to the discovery of processes of packing by which the nuts can be transported to any country without deterioration or insect attack. These nuts are now packed by a patented process in tight containers from which the air is exhausted and replaced by gases, said to be chiefly carbonic acid, in which they are prefectly preserved. Information received from the Bureau of Foreign and Domestic Commerce of the United States reveals the fact that 10,262,916 pounds of cashew nuts were imported into the United States in the year 1931. These were entered at a value of $ 2,052,240 which intended to represent their market value in the principal markets of the country which exported, including the cost of containers or coverings and all expenses incidental to placing the merchandise in condition ready for shipment to the United States. In 1932, the imports were slightly under 9,800,000 pounds which represent a very small shrinkage compared with the general falling off in trade in that year of general business depression.

It is worthy of note that nearly the entire importation comes from British India and not from its home in tropical America. Considering the fact that the cashew grows almost as a weed in Panama and yields abundantly even in rather poor soils, it would appear that attention should be given to the possibilities of developing a cashew industry here much nearer to the market. To do this it would be necessary to interest the importing companies in stimulating trade and production here. The climate, the soil, the proximity to market and the facilities for shipping are all in favour of such an industry.

The Canal Zone Experiment Gardens have introduced several varieties of cashew of unusual size and appearance all of which are doing well and yielding abundantly. They are now in correspondence with Brazil in an effort to get some of the best varieties from that country which is believed to be the home of this fruit and which probably makes a wider use of it than any other part of the Western hemisphere. (*The Planters' Chronicle*, Vol. XXXIV, No. 3, February 1939).

Gleanings.

Bacterial Wilt and Soft Rot. Bacterial wilt and soft rot has been responsible for serious losses in widely separated potato areas ever y effort should be made to see that it does not become more wide-spread. Racicot in Canada, Bonde in Maine, Burkholder in New York and Eddins in Florida have made valuable contributions to our knowledge of the disease. The information available as the result of their researches has been of very great value in guiding our efforts to eradicate this threat to the crop.

In our endeavor to prevent the spread of this disease we must not overlook the valuable contributions made by those in charge of seed potato certification. In one of the north-eastern states, for example, in the Spaulding Rose variety, twenty-eight per cent of the acreage was rejected because of this disease in 1937. In 1938, only 3·3 per cent of the acreage planted with this variety showed any of

the trouble. Drastic action on the part of the certification officials was responsible for bringing about this reduction. Two years ago when the seriousness of this disease was first fully appreciated, the certification authorities agreed to reject any field in which the disease was found. This year, despite the fact that many fields entered for certification passed all other requirements they were rejected because as few as one or two plants infected with bacterial wilt and soft rot were found. This required a high degree of courage on the part of the certification officials since it resulted in a serious loss to the seed growers.

All those interested in the potato industry appreciate what the men in charge of seed potato certification are doing to produce good seed potatoes. These men are on the firing line. It is they who must see that the recommendations of the research workers are carried out. In some cases in their efforts to do so their jobs are in jeopardy. If they are to succeed in their efforts to produce high class seed potatoes they must continue to have the advice and support of the plant pathologists. (*American Potato Journal*, Vol. 16, No. 1, page 1).

Cashew Oil and Mosquitoes. The Haffkine Institute, Bombay, recently undertook an investigation to discover a suitable toxic substance which, added to the oil film, produced rapid death in a large number of larvae and pupae within as short a time as possible. It was found that the addition of cashew nut-shell oil to kerosene or high.speed Diesel oil increased their killing power three times when tested under laboratory conditions. This activation of the oil at the same time proportionately decreased the cost of the anti-mosquito measures. Working with larvae and pupae of *Armigeres obturans*, a culcine mosquito commonly occurring in Bombay, it was found that while 3 ml. per square foot of kerosene oil alone was necessary to obtain a 100 per cent. kill, 1 ml. of mixture of 5 parts of cashew nut-shell oil and 95 parts of kerosene of high-speed diesel oil was adequate for the purpose. India at present holds a monopoly of cashew nut-shell oil, which is obtained as a byproduct during the production of cashew nut kernels. The tree, *Anacardium occidentale*, originally introduced from South America, has well established itself in the coastal forests of India. The oil referred to above is used for painting wood, as a protection against insects, and is exported to America and Europe for paint mixtures. (*The Planters' Chronicle*, Vol. XXXIV, No. 3, February 1939.)

Washing Dirty Eggs. Experiments conducted at the Missouri Agricultural Experiment Station have at last over-come the problem of dirty eggs. When washed in the ordinary way the eggs could always be picked out because the "bloom" of the shell was removed in the process and washed eggs never kept so well in cold storage and always commanded a lower price. It has now been found that if washed in lye made from 1 oz. caustic soda to a gallon of water the eggs kept well in cold storage as did naturally clean eggs of similar quality. When sold they commanded a price equal to that received for naturally clean, unwashed eggs.

Furthermore, experienced dealers in eggs could not detect the eggs which had been washed ; and cooking tests after eight and ten months' storage showed that the dirty eggs which had been washed in lye water were of equal quality to the clean eggs stored at the same time.

Because of the caustic properties of the lye solution, rubber gloves should be used when washing the eggs, but the fact that soiled eggs can be treated in such a way as to reduce to a minimum losses due to their becoming dirty, suggests a possible solution to this vexing problem of how to handle dirty eggs. (*Rhodesia Agricultural Journal*, Vol. 36, No. 1, pp. 4).

Zinc sulphate as a fertiliser for wheat. According to the *Pastoral Review*, a new line of research is being undertaken by the Department of Agriculture of

Victoria to investigate the surprising results obtained from the application of very small dressings of zinc sulphate to wheat lands. The effect was first noticed by research officers of the Department when testing this chemical against the eelworm of wheat. It will be interesting to learn whether the effect is due to zinc deficiency in the soils or whether some other factor is involved. At Nhill the addition of 30 lb. zinc sulphate per acre has produced spectacular increase in yield of from five to 9·4 bushels, and at Longerenong an increase of 2·1 bushels has been obtained. Zinc sulphate costs about £ 23 per ton, so a dressing of 30 lb. per acre would run to about 6 s., which leaves a good margin for profit. Why the chemical increases the yield is not clear, and as the discovery is yet in its infancy, farmers are advised to be chary with its use outside trial areas. It has been demonstrated in the Victorian Wimmera that light applications cause the wheat to mature exceptionally early. (*Rhodesia Agricultural Journal*, Vol. 36, No. 1, pp. 4—5).

Agricultural Jottings.

A SIMPLE DEVICE FOR COVERING SEED SOWN WITH THE DRILL

In the black soil tracts of the south the chief crops grown are cotton and *cumbu* besides *cholam* raised for fodder. The general method of sowing is to broadcast the seed and cover it with the country plough. The practice of drill sowing is also being followed by a number of cultivators.

2. At the Agricultural Research Station, Koilpatti, the crops are always sown with the drill. Originally a two-tyned gorru with tynes 18″ apart was used for sowing cotton and *cumbu*. Although this is an improvement over the local method it was found capable of considerable improvement since the area covered by this was not appreciable, the draught was too light for an ordinary pair of bullocks, and it was also noted that the implement was rather unsteady and had a tendency to work deeper than necessary. As a consequence this was replaced by a three-tyned drill to start with and then quickly changed to a four-tyned one to make it more economical. This four-tyned *gorru* would cover an area of 12 acres in a day of 8 hours. With the development of the drill the ordinary sized *guntaka* with a 3′ blade could not cope up for covering the seed and therefore the width was increased to 4½ feet to keep pace with the four-tyned drill.

3. To get the proper germination either in cotton or in *cumbu* it is highly important that the seed has to be sown as shallow as possible at a depth of not more than two inches. The covering implement that follows should work in such a way that the seed deposited in the furrows is not lifted. To achieve this the *guntaka* has to be very near the yoke so that the blade just moves on the surface of the soil and therefore it will have to work in the space between the two animals. This requires the provision of a long yoke to allow sufficient space and avoid the feet of the animals being hurt. Under the prevailing conditions of the soil at the time of sowing it is not necessary to work the blade since the operation is intended only to put back into the furrows the soil lifted by the tynes of the drill. Any straight piece of wood or iron would serve the purpose quite well but a certain amount of weight is essential to adjust to the slight irregularities in the level of the field. A piece of angle iron was found to satisfy these conditions.

4. A 2″×2″×¼″ angle iron, 18 feet long, was cut into two pieces of 9 feet each. In one of the arms of the angle two holes of ½″ size were drilled at a distance of 3 feet apart in the middle. To these holes the two ends of an ordinary plough chain were hooked and it was tied to the yoke pole. To the other arm of the angle a handle was fixed. The weight of the whole implement

including the chain is 40 lbs. and it costs Rs. 3—13—0 each complete. It is an easy work for a small pair of animals and a comfortable job for a lazy driver. The ordinary *guntaka* costs Rs. 3/- but covers only half the area with the advantages mentioned above.

5. The advantages in this new device are :—

(a) It is extremely simple in design and needs no skill either in making or working it.

(b) It covers a large area and copes up with two four-tyned drills and thus saves a pair of bullocks and a man.

(c) The risk of lifting the seed from the soil is avoided.

(d) There is no necessity to have a long yoke pole and there is absolutely no danger of any injury to the animals' feet.

(e) The covering is very efficient. The experience shows that it can safely be recommended to any cultivator who adopts drill sowing.

Crop and Trade Reports.

Cotton—1938-39—Fourth Forecast Report. The average of the areas under cotton in the Madras Province during the five years ending 1936-37 has represented 9·6 per cent. of the total area under cotton in India.

2. The area under cotton up to the 25th January 1938 is estimated at 1,873,900 acres. When compared with the area of 2,512,000 acres estimated for the corresponding period of last year, it reveals a decrease of 25·4 per cent.

368,500 acres have been reported as sown since the last December forecast was issued. This extent is made up of 235,000 acres under Tinnevellies, 62,000 acres under Northerns and Westerns, 44,400 acres under Cambodia, 14,100 acres under Cocanadas, 12,400 acres under Salems and 600 acres under other varieties of cotton. The area sown in December and January falls short of that sown in the corresponding period of the previous year by 24,900 acres or by 6·3 per cent.

3. The decrease in area in the current year as compared with the area in 1937-38 occurs in all the important cotton-growing districts of the Province and is attributable largely to unfavourable seasonal conditions.

The area under irrigated cotton mainly Cambodia is estimated at 162,200 acres as against 271,700 acres for the corresponding period of the previous year, a decrease of 40·3 per cent.

4. Pickings of the mungari or early sown cotton crop in the Deccan have concluded. The yield was normal on the whole.

The crop was affected by the failure of the northeast monsoon rains and yields below normal are reported from all the important cotton-growing districts except Kurnool and Anantapur where the yield is expected to be normal. The estimated yield is lowest for dry cotton in Coimbatore (75 per cent.) owing to the attack of insect pests and diseases.

5. The seasonal factor for the Province as a whole works out to 94 per cent. of the average as against 80 per cent. in the previous year. On this basis, the total yield is estimated at 375,800 bales of 400 lb. as against 488,600 bales for the corresponding period of the previous year. It is, however, too early to estimate the yield with accuracy as the harvest has not yet commenced in the major portion of the area and much will depend upon the future weather conditions and the toll taken by insect pests.

6. The estimated area and yield under the several varieties are given below:-

(*Area in hundreds of acres, i. e.,* 00 *being omitted ; yield in hundreds of bales of* 400 *lb. lint, i. e.,* 00 *being omitted.*)

Variety.	Area from 1st April to 25th January.		Corresponding yield.	
	1938-39	1937-38	1938-39	1937-38
	Acs.	Acs.	Bales	Bales
(1)	(2)	(3)	(4)	(5)
Irrigated Cambodia ...	153,0	259,7	87,9	158,6
Dry Cambodia	178,4	306,2	34,1	62,7
Total, Cambodia ...	331,4	565,9	122,0	221,3
Karunganni in Coimbatore	57,2	137,0	10,5	29,7
Uppam in the Central districts	18,6	32,0	2,7	4,9
Nadam and Bourbon ...	3,3	25,2	2	1,2
Total, Salems ...	79,1	194,2	13,4	35,8
Tinnevellies *	458,0	529,5	112,1	123,9
Northerns and Westerns	882,0	1,086,0	106,8	84,1
Cocanadas ...	117,6	129,4	20,8	22,6
Others	5,8	7,0	7	9

* Includes Uppam, Karunganni and mixed country cotton in the south.

7. The average wholesale price of cotton lint per imperial maund of 82⅖ lb. as reported from important markets on 6th February 1939 was Rs. 15--1--0 for Cocanadas, Rs. 14—13—0 for red Northerns, Rs. 13-7-0 for white Northerns, Rs. 12 for Westerns (mungari crop), Rs. 13—9—0 for Westerns (jowari crop), Rs. 24-15-0 for Coimbatore Cambodia, Rs. 18--14—0 for Southern Cambodia, Rs. 21—10—0 for Coimbatore Karunganni, Rs. 18--14—0 for Tinnevelly Karunganni, Rs. 17 for Tinnevellies and Rs. 17—14—0 for Nadam cotton. When compared with the prices published in the last report, i e., those which prevailed on 9th January 1939, these prices reveal a rise of about one per cent. in the case of Coimbatore Karunganni and a fall of about eight per cent. in the case of Southern Cambodia and Tinnevellies, six per cent in the case of Westerns (mungari crop), five per cent. in the case of Tinnevelly Karunganni and one per cent. in the case of Coimbatore Cambodia, Westerns (jowari crop) and Cocanadas ; the prices of Northerns (red and white varieties) and Nadam cotton remaining stationary.

(*From the Director of Industries and Commerce, Madras*).

Cotton raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 17th March 1939 amounted to 30,222 bales of 400 lb. lint as against an estimate of 375,800 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 40,319 bales. 48,000 bales mainly of pressed cotton were received at spinning mills and 15,380 bales were exported by sea while 30,997 bales were imported by sea mainly from Karachi, Egypt and Bombay.

(*From the Director of Agriculture, Madras.*)

Correspondence.

Agricultural Propaganda.

To

The Editor,

Madras Agricultural Journal.

Dear Sir,

Nice songs on agricultural improvements are sure to impress the listeners. Gramophone and the Radio might be useful for agricultural propaganda; but in the present day (be it in the town or village) the cinema theatre is the main attraction for the crowds and the talkie films are becoming increasingly popular. We can now find touring cinemas visiting even the remotest villages and showing films to audiences composed mostly of agriculturists. Nothing will be more impressive or effective than a short talkie film on some particular agricultural improvement shown at these village cinema theatres in the right time and season.

The Government and the philanthropic gentlemen of this province will be doing a distinct service to the agriculturists if they can help in the production of such films relating to local agricultural conditions. The proprietors of the touring cinemas will be only too glad to show these films free of any cost.

Chandragiri,
18—2—'39.

K. Raghunada Reddy,
Agricultural Demonstrator.

To

The Editor,

Madras Agricultural Journal.

Sir,

I heartily endorse the methods advocated for Agricultural propaganda work by the "Member of the Madras Agricultural Students' Union" in your issue of January 1939. May I refer the member to my paper on "A much needed link in Agricultural dissemination work" read before the last College Day and Conference (vide Madras Agricultural Journal 1938 XXVI No. 9 pages 319—329). where I have stressed the important role the gramaphone records and auto-truck movies or talkies will play in the agricultural propaganda work.

Let me give my little personal experience I had when I was in charge of the Exhibition Van for a short period in the year 1932. To have some past-time in the remotest villages the touring Veterinary Assistant who accompained me casually thought of bringing his private gramaphone set with him But lo! it worked miracles. When the switch was off the poor folks returning from the hum-drum of village life used to gather in such large numbers that we found very little difficulty in getting a good audience for all our exhibitions and lantern lectures; Gramaphone records will therefore be a great asset to the Agricultural Demonstrators. Semi-private agencies like the one working in Bombay should be encouraged by the state in preparing records on agricultural subjects.

But, I believe that in these days of Cinema fad auto-truck movie or talkie will do better and quicker work. It will create a better and more lasting impression in the minds of villagers. The Horlics Co., and the Lux Toilet Soap Co., are using such auto-trucks only. The Negro Extension scheme in America is worked with the help of such motor units. In this connection I refer the readers

to the book on "The American and the Cinema" by L. A. Notcutt and G. C. Latham; also to the article in the Empire Cotton Growing Review, Vol. XV, 1938 on the use of films in African agriculture by the latter author. The book gives a full account of the success of films in the African villages and its appendix describes how easy and cheap it is to prepare films in India. Talents are not wanting in India. Even in our own province, thanks to the efforts of our Ex-Director, Sri S. V. Ramamurty, some two dozen plays, both in Tamil and Telugu, were written and the best of them awarded gold medals. The Tamil play written by Sri S. Rajarathnam was even enacted during one of our College Day and Conference and was much appreciated. The Tamil and Telugu plays are worthy of being printed and filmed. The Cinema owners will be only too glad to put these short plays on the screen just before their daily shows. Mr. Latham, in the article referred to above, estimates the cost of portable unit with a sound-on-disc and an amplifier as £ 80 only. A unit of this kind can, with advantage, be easily attached to the Motor Exhibition Vans run by our Agricultural Department.

Lawley Road
20—2—'39. N. C. Thirumalachary.

Association of Economic Biologists.

The Annual General Body meeting of the above association was held on the 24th February 1939, under the presidentship of Rao Bahadur V. Ramanatha Ayyar. After the accounts for 1938 and the budget for 1939 were passed the following office-bearers were elected:

President;	Rao Bahadur T. S. Venkataraman, B.A., C.I.E., I A.S.
Resident Vice-President:	Sri. M. C. Cherian.
Moffusil ,, ,,	Dr. J. S. Patel.
Secretary:	Sri. C. R. Srinivasa Ayyengar.
Members of the Committee	Rao Bahadur V. Ramanatha Ayyar. Sri. K. M. Thomas.

Sri. V. Gomatinayagam Pillai was elected auditor.

The incoming President then took the chair. In the absence of Dr. J. S. Patel, the retiring president, his address on "Groundnut in Madras" was read by Rao Bahadur V. Ramanatha Ayyar. With a vote of thanks to the retiring Committee, the meeting terminated.

A public lecture was held under the auspices of the Association on 1—3—39 when Mr. D. N. Mahta, B. A. (Oxon), F. L. S., Secretary, Indian Central Cotton Committee, gave a talk on "Cotton Improvement Work in the Central Provinces". In the course of the talk, the lecturer said that the chief problem of his Province was the improvement of staple-length and the disposal of its surplus production. As a result of selection work during 1923-30 *Verum 262* which had good length and was at the same time resistant to wilt was evolved. It was however very much affected by climatological factors. Two other selections obtained subsequently, *Late verum* and *434* met this defect to a large extent—the former in places of heavy rainfall and the latter in less favoured regions. Summing up the lecturer said that the problem of disposal of surplus cotton in India required immediate attention, since Japan, the biggest consumer of our cotton was likely to turn to other sources of raw cotton. It was suggested that the solution of the problem should be sought not in a general curtailment of the area under cotton but in increasing our yield per acre and replacing the short-stapled types by long stapled ones.

College News and Notes.

Students' Club. The students' Club Day was celebrated this year on the 25th of February under the presidency of Sri O. Pulla Reddi, M.A., I.C.S. The function, which was well attended, commenced at 4-30 P. M. with tea and fancy dress competition after which the guests and students adjourned to the well decorated Freeman Hall. The reports of the Library and Games sections of the Students' Club were presented by the respective Secretaries The president distributed the prizes to the winners in the various games and tournaments conducted in connection with the Club Day. " The Club Day Rag ", which was then presented, was much appreciated by the audience. This was followed by a variety entertainment. The happy function terminated with the Presidential address, followed by a vote of thanks proposed by the Principal.

Cricket. The last match of the season was played against the Anamalais Club at Valparai. Batting first, our College was unlucky to score for the first time below 100. Our team made only 97, but thanks to the fine efforts of Dinker Rao and Kothandaraman with the leather, the home team was skittled out for 73 after they made a good start.

Visitors. Sri P. H. Rama Reddi, M.A., I.A.S., Director of Agriculture, Madras, arrived here on the 3rd and camped till the 6th inst. when he left for Madras.

Mr. D. N. Mahta, B.A. (Oxon) F. L. S., Secretary, Indian Central Cotton Committee was another distinguished visitor to the College. He was here for 3 days from the 27th February.

The late Sri. A. V. Tirumuruganatham Pillai.

We are sorry to record the sad demise at his residence in the Agraharam street, Erode, of Sri. A. V. Tirumuruganatham Pillai, Retired Assistant Director of Agriculture.

Born in April 1874, he took his L. Ag. diploma in the Saidapet Agricultural College and entered Government service on the 15th May 1896. He was appointed as Assistant Director of Agriculture on the 15th January 1918. He worked as Assistant Director of Agriculture at Vellore, Guntur, Madura and Trichinopoly. Once in 1920 and again in 1928 he held charge of the office of the Deputy Director of Agriculture at Madura and Guntur, respectively. Retiring on the 16th April 1929, Sri. Pillai engaged himself in beneficial public activities. He served as an honorary magistrate of the local first class Bench Court. As a Director of both the Erode Co-operative Land Mortgage Bank, Ltd., and the Co-operative House Mortgage Bank, Ltd., he did useful work. Of a pious disposition, he worked as a trustee of the local Kongalamman Devasthanam.

Even after his retirement he continued to serve as a moffusil Vice-President of the Madras Agricultural Students' Union.

We express our heartfelt condolence to the members of the bereaved family.

The late Sri. K. Vasudeva Shenai.

We are sorry to learn of the sad demise on the 4th February 1939 of Sri. K. Vasudeva Shenai, Agricultural Demonstrator, Coondapur, after an attack of pneumonia. At the age of 44, in the prime of youth, Sri. Shenai has been snatched away by death. A conscientious and able worker, he was liked by one and all.

Our sincere condolence to the members of his family.

Notifications.

The following letters received by the Principal, Agricultural College, have been forwarded to us, for publication in the Madras Agricultural Journal. Intending applicants may submit their application direct to the Officers concerned.

Copy of letter No. C 596/39 E. dated 19th February 1939 from the District Forest Officer, Salem North, Hosur Cattle Farm.

"I am in need of 2 or 3 "FIELDMEN" to work under the Spike Research Ranger at Denkanikota. Their work will be mostly entomological—collecting, sorting and releasing insects in cages, killing insects, mounting them etc. Insects have to be collected in fields and in forest areas during day as well as during night, according to necessity. "FIELDMEN" come under "work-charged" establishment and belong to no service (neither permanent nor temporary). As "Fieldmen" they will be paid Rs. 30/- a month. If their work and conduct are found to be satisfactory in the course of 6 months or a year, they will be appointed as Temporary Foresters in the Madras Forest Subordinate service on a pay of Rs. 28/- plus Rs. 8—12—0 as Fixed Travelling Allowance, per mensem. Men qualified for Forester's posts are therefore necessary.

2. Qualifications for a Forester's post are :—

(a) Age :— Not more than 25 years on the date of appointment as Forester.

(b) Physical

Minimum height 5' 5"

Minimum measurements round the chest } (a) on full expiration 32" (b) on full inspiration 34"

(c) Educational, Madras S. S. L. C. with marks obtained at the Public Examination as specified below :—

	Brahmin, Non-Brahmin (Hindu), Anglo-Indian, Christian or Non-Asiatic not less than.	Others not less than
Group A.		
English	40%	35%
A. Language	40%	35%
Elementary Mathematics	35%	35%
Elementary Science	30%	30%
Outlines of History of England and India and Geography	30%	30%
Group C.		
In one of the subjects	35%	35%

3. Mr. Griffith, Provincial Silviculturist, informs me that you may be able to help me in the matter of finding suitable candidates for the posts of "Field-men" on terms set forth above. I shall be very thankful if you will very kindly put me on to such men that you may know or ask them to apply to me."

Copy of letter dated 25th January 1939 from the Imperial Chemical Industries (India) Ltd., Madras.

"We have a vacancy for a Telugu-born Graduate of the Coimbatore Agricultural College and should be much obliged if you could furnish us with a list of recent graduates who are still unemployed."

The following correspondence on the Training of Agricultural Research workers has been sent to us by the Director of Agriculture, Madras for publication in the Madras Agricultural Journal :—

Copy of letter No. F. 16-6/38-E dated the 26th January 1939, from the Secretary to the Government of India, Department of Education, Health and Lands, New Delhi, to all Provincial Governments and Local Administrations (including Andamans and Panth Piploda).

Training of Agricultural Research workers—Advice to Indian Students intending to proceed abroad to study Agricultural Science.

In continuation of this Department letter No. F. 16-6/38-E, dated 18th July. 1938, I am directed to forward for information and such action as may be deemed necessary, a copy of a letter No. D. 8006/38-AI, dated the 6th January 1939, with enclosures, from the Secretary, Imperial Council of Agricultural Research, to the Educational Commissioner with the Government of India, on the subject mentioned above.

Copy of letter No. D. 8006/38-AI, dated the 6th January 1939, from the Secretary, Imperial Council of Agricultural Research to the Educational Commissioner with the Government of India.

Subject :— *Training of agricultural research workers.*

I am directed to invite a reference to your endorsement No. F. 16-6/38-E, dated the 18th July 1938 and to forward herewith for information a copy of the marginally* noted correspondence with the Secretary, Students Advisory Committee in Sind.

*1. Letter from the Secretary, Students Advisory Committee, Sind, Karachi, No. S. 147/7875-A dated the 18th August 1938.

2. Letter to the Secretary, Students Advisory Committee, Sind, Karachi, No. F. 135/36-A, dated the 1st September 1938.

Copy of letter No S. 147/7875-A dated the 18th August 1938, from the Secretary, Students Advisory Committee, Sind, to the Vice-Chairman, Imperial Council of Agricultural Research, Rock House, Simla.

Training of Agricultural Research Workers.

I have the honour to state that some students who are in the final B. Sc. course at the Agricultural College, Poona intend going up for Research work to some foreign Universities. From your letter No. F. 135/36-A of 18—6—1938 addressed to the Educational Commissioner with the Government of India, I find

that there appears to be very good provision in your college for doing Research work in Agriculture for the Science Students. I would like to know for the benefit of students who have passed *B. Sc. in Agriculture* whether it will be equally profitable for them to pursue their research studies in your college rather than go to some foreign University. Apart from the question of provision of proper facilities for Research work, what they are specially anxious to know is whether the value of the degree acquired in your college will be equally helpful to them for securing Government service or any other service under state or some responsible Bodies as any foreign degree. As it is, an Indian student thinks lightly of Indian degrees because the Hall-mark of a foreign University helps him better to get Government service. I, therefore, request you to let me know whether there are any Government orders placing the M. Sc. degree of your institute on par with a similar degree of foreign Universities. I will also like to know the conditions of admission in your institute. For this purpose you might kindly send to me prospectus of the College and any other literature bearing on the point.

Copy of letter No. F. 135/36-A, dated the 1st September 1938, from the Secretary, Imperial Council of Agricultural Research, Simla, to the Secretary, Students Advisory Committee, Sind, Karachi.

Subject :— *Training of Agricultural Research Workers.*

With reference to your letter No. S. 147/7875-A dated the 18th August 1938, I am directed to say that the post-graduate course at the Imperial Agricultural Research Institute, New Delhi, leads to a post-graduate diploma and not to a degree. This diploma is a recognised qualification for service in the Agricultural Departments of this country and the diploma holders can, as a general rule, obtain employment without any difficulty, whilst the same cannot be said of all holders of foreign degrees. It has also been found from experience that men who have done best and gained most advantage from an advanced study in agriculture abroad are those who have worked in an Agricultural Department or a research institute in India before going abroad. The value of a foreign degree is much enhanced if it is preceded by the post-graduate course at the Imperial Agricultural Research Institute, New Delhi. You are therefore advised to send students to the Imperial Agricultural Research Institute for taking the diploma before sending them abroad for foreign degree.

For prospectus and further particulars of the post-graduate courses at the Institute you may please apply to the Director of the Imperial Agricultural Research Institute, New Delhi.

Weather Review—FEBRUARY 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	−0·7	0·0
	Calingapatam	0·0	−0·5	0·2
	Vizagapatam	0·0	−0·9	0·0
	Anakapalli*	0·0	−1·3	0·2
	Samalkota*			
	Maruteru*	0·0	−1·0	0·2
	Cocanada	0·0	−0·3	0·2
	Masulipatam	0·0	−0·4	0·0
	Guntur*	0·0	−1·1	0·0
Ceded Dists.	Kurnool	0·0	−0·2	0·0
	Nandyal*	0·0	0·0	0·0
	Hagari*	0·0	−0·3	0·0
	Siruguppa*	0·0	−0·3	0·0
	Bellary	0·0	−0·2	0·0
	Anantapur	0·0	−0·3	0·0
	Rentachintala	0·0	...	0·0
	Cuddapah	0·0	−0·1	0·1
	Anantharajupet*	0·0	0·0	2·9
Carnatic	Nellore	0·0	−0·1	1·0
	Madras	0·0	−0·3	0·7
	Palur*	0·0	−0·7	3·0
	Tindivanam*	0·0	−1·0	0·7
	Cuddalore	0·0	−0·9	3·5
Central	Vellore	0·0	−0·3	2·0
	Salem	0·0	−0·3	0·6
	Coimbatore	0·0	−0·3	2·3
	Coimbatore A. C. & R. I.*	0·0	−0·5	2·1
	Trichinopoly	0·0	−0·5	1·9

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·0	−0·6	1·4
	Aduthurai*	0·0	−0·5	2·4
	Madura	0·4	0·0	1·3
	Pamban	1·5	+0·8	3·3
	Koilpatti*	0·7	+0·2	2·6
	Palamkottah	0·2	−0·6	2·3
West Coast	Trivandrum	0·6	0·0	1·1
	Cochin	0·0	−0·8	0·0
	Calicut	0·0	−0·2	0·1
	Pattambi*	0·0	−0·5	0·0
	Taliparamba*			
	Kasargode*	0·0	−0·2	0·0
	Nileshwar*	0·0	−0·2	0·0
	Mangalore	0·0	−0·1	0·0
Mysore and Coorg	Chitaldrug	0·0	−0·1	0·0
	Bangalore	0·0	−0·2	0·6
	Mysore	0·0	−0·2	0·3
	Mercara	0·0	−0·2	0·9
Hills	Kodaikanal	4·8	+3·4	8·5
	Coonoor			
	Ootacamund*	0·1	0·0	1·4
	Nanjanad*	0·7	+0·1	1·2

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette

Except for a few isolated light showers in Southeast Madras on the 16th, 17th, 18th and the 23rd dry weather prevailed in the peninsula. Rainfall was generally in defect.

Skies were lightly to moderately clouded in Southeast Madras and clear or lightly clouded elsewhere.

Humidity was in defect. Temperatures were generally normal.

Weather Report for Research Institute Observatory.

Report No. 2/39.

Absolute Maximum in shade ...	...	93·0°F
Absolute Minimum in shade ...	...	56·8°F
Mean Maximum in shade ...	...	89·8°F
Departure from Normal ...	...	0·7°F

Mean Minimum in shade	...	...	64·8°F
Departure from normal	...	...	-1·0°F
Total Rainfall ...	...	...	Nil.
Departure from normal	...	...	-0·5"
Mean daily wind velocity	...	...	3·5 m. p. h.
Departure from normal	...	...	+0·75 m. p. h.
Mean humidity ...	...	...	65·7%
Departure from normal	...	...	-6·2%

Summary:— Weather was dry throughout the month. The skies were clear or lightly clouded. Rainfall was in defect by 0·5". The day and night temperatures were below normal.

P. V. R. & J. C.

Departmental Notifications.

Gazette Notifications.

Appointments.

Sri L. Narasimha Acharya, Agricultural Demonstrator, Chittoor. is appointed to the Madras Agricultural Service in Category 6—to officiate as Assistant Director of Agriculture, Nellore, Vice Sri V. G. Dhanakoti Raju on leave.

The services of Sri T. Narayana Rao, Assistant in Millets, Agricultural Research Station, Guntur are placed at the disposal of the Government of India for appointment as Superintendent, Tobacco Sub-station, Guntur for a period of three years.

Leave.

Name of officers.	Period of leave.
Sri V. G. Dhanakoti Raju, Offg. Asst. Director of Agriculture, Nellore.	L. a. p. on M. C. for 3 months from 17—2—39.
,, R. Chokkalingam Pillai, Asst. Director of Agriculture, Tinnevelly.	L. a. p. for 3 months from 3—3—39.

1. Appointments.

The following provisionally substantive appointments of upper subordinates in the Science section and Agricultural section in the III grade (new) are ordered with effect from 14th January 1938.

Science section :— Messrs. E. J. Varghese, N. G. Narayana and B. Suryanarayana Rao.

Agricultural section .— Messrs C. K. Ramachandran, M. L. Balasundaran P. Abdul Samad Sahib and K. C. Thomas.

2, Promotions.

The following provisionally substantive promotions of upper subordinates in the Agricultural section are ordered with effect from the 14th January 1938. From V grade to IV grade. Rs. 85—5—120 to Rs. 120—10—170.

Messrs. S. V. Doraiswami Ayyar. Farm Manager, Agricultural Research Station, Guntur and V. Chidambaram Pillai, Farm Manager, Agricultural Research Station, Koilpatti.

Transfers.

Name of officers.	From	To
Mr. P. Israel,	Offg. Asst. in Entomology, Coimbatore,	Temporary Asst., A. R. S., Anakapalle.
Sri K. Brahmachari,	Entomology Asst,. Nellore,	Temporary Asst., A. R. S., Gudiyatam.
,, C. Krishnamurthy,	Offg. Asst., Millets Section, Nandyal,	Offg. Asst., Entomology Section, Coimbatore.
Janab Ali Hyder Sahib,	A. D., Kudligi,	Offg. F. M., A. R. S., Siruguppa.
Sri K. Sriraman,	Offg. Assistant, Chemistry Section, Coimbatore,	Temporary Asst. in Chemistry, A. R. S., Siruguppa.
Mr. James Colaco,	Temporary Asst. in Chemistry, A. R. S., Siruguppa,	Offg. Asst. in Chemistry, Coimbatore.
Sri G. C. Balanna,	A. D., Koilkuntla,	A. D., Allagadda.
,, G. Konda Reddy,	A. D., Allagadda,	A. D., Tadpatri.
Janab Varsai Muhammad Sahib,	Offg. Upper Subordinate, Agricultural Section,	Offg. Asst. in Oil Seeds, Tindivanam.
Sri K. Tejappa Shetty,	A. D., Sugarcane Subsidy Scheme, Kalyanpur,	A. D., Coondapur.
,, S. V. Parthasarathy,	A. D., Tadpatri,	A. D., Chittoor.
,, V. G. Venkataramana Rao,	A. D., Palmanir,	A. D., Kudligi.
,, M. Krishnaswami,	A. D., Rayadrug,	Sugarcane Growers Co-operative Union, Hospet.
,, I. Sambasiva Rao,	A. D., Bezwada,	A. D., Chellapalli for Exhibition work.
,, K. Govinda Kurup,	A. D., Mudukulatur,	A. D., Parmakudi.

Leave.

Name of officers,	Period of leave.
Sri T. Seshachalam Naidu, A. D., Kaikalur.	Extension of l. a. p. for 18 days from 19—3—39.
,, S. Rama Rao, Sugarcane Growers Cooperative Union, Hospet.	Extension of l. a. p. for 1 month from 12—2—39.
,, C. S. Balasubramaniam, Asst. in Entomology, Cuddapah.	L. a. p. on m. c. for 10 days from 24—2—39
,, M. Narayana Ayyar, A. D.. Polur.	L. a. p. for 1 month from 15—3—39.
,, P. V. Samu Ayyar, A. D., Sankarankoil.	L. a. p. for 2 months from the date of relief.
,, P. R. Subramania Ayyar, A. D., Udayagiri.	L. a. p. for 4 months from 3—3—39.
,, A. Shanmugasundaram, Offg. F. M., Aduturai.	L. a. p. for 31 days from 6—3—39.
,, Y. Venkataswami, A. D , Dhone.	L. a. p. for 21 days from 16—3—39.
,, S. P. Fernando, A. D., Bhavani.	Extension of l. a. p. for 15 days from 3—1—39.
,, A. G. Ramaswamiah, Asst. in Entomology, Coimbatore.	L. a. p. for 2 weeks from 6—3—39.
,, K. Gurumurthy, A. D., Chellapalli.	L. a. p. for 24 days from 13—3—39.
,, M. C. Krishnaswami Sarma, A. D., Sivaganga.	L. a. p. for 4 months from 15—3—39.

Sri. P. V. Subba Rao, A. D. (on leave).	L. a p. for 3 months from 15—1—39.
„ V. K. Appaji, A. R. S., Palur.	L. a. p. for 24 days from 3—3—39.
„ C. A. S. Ramalingam Pillai, A. D., Ariyalur.	L. a. p. for 4 weeks from 8—3—39.
„ A. Alagiamanavalan, A. D., Punganur.	L. a. p. for 27 days from 4—4—39.
„ A. M. Muthayya Nattar, A. D. (on leave).	Extension of l. a. p. on m. c for 30 days from 22—2—39.
„ N. G. Narayana, Asst., Mungari Cotton scheme.	Leave with allowance for 25 days from 12—4—39.
„ P. Naghadara, A. A. D., Madakasira.	L. a p. for 12 days from 6—3—39.
„ S. Veeravaradha Raju, A. D., Trivellore.	L. a. p. for 2 months from the date of relief.
„ N. Narayana Ayyar, A. D., Attur.	L. a. p. for 14 days from 21—2—39.
„ N. Raghava Rao, A. D., Narasannapata.	Extension of l. a. p. on m. c. for 4 months from 12—2—39.
„ G. J. Balraj, A. D., Pattukottai.	L. a. p. on m. c. for 3 weeks from 13-3-39.
„ K. Hanumantha Rao, A. D., Hospet.	L. a. p for 2 months from 26—2—39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during February 1939.

A. Books.

1. *Report on the Soil Survey of Cochin State.* Cochin Agri. Dept. Pub. (1938). 2. *The New Farming.* Robinson, D. H (1938). 3. *British Agriculture: A Report of an Enquiry.* Viscount Astor & Rowntree, R. S. (1938) 4. *Manual of Mushroom Culture.* Rettew, G. R., Etc. (1938). 5. *Electroculture—2 Volumes. (Pamphlets of the Mainpuri Electroculture and Fruit Growers Association).* 1935-38. 6. *Agricultural Holdings in the United Provinces.* Jain, B. E. (1937). 7. *Milk Records of Cattle in approved Dairy Farms in India.* Kartha, K. P. R. (1938). 8. *Cattle Fodder and Human Nutrition.* Virtanen, A. I. (1938). 9. *The Structure and Development of the Fungi.* Gwynne-Vaughan, H. C. I. & Barnel, B. (1937). 10 *Propaganda.* Lambert, R. S. (1938). 11. *Simplified Statistics.* Holman, L. J. (1938).

B. Annual Reports Etc.

1. Subordinate Officers of the Madras Agri. Department for 1937-38. 2. Nagpur, Agricultural College, Central Provinces, Agri. Department Report for the year ending 31st March 1938. 3. Report of the Central Provinces, Dept. of Agri. for the year ending 31st March 1938. 4. Sind Annual Report Agri. Dept. for the year ending 30th June 1937. 5. Proceedings of Association of Economic Biologists, Coimbatore, Vol. V, 1937. 6 Annual Report of the Indian Central Cotton Committee for the year ending 31st August 1938 7. Report of the Zoological Survey of India for 1935 to 1938. 8. Annual Administration Report of Hyderabad H. E. H. Nizam's Govt. for 1346 Fasli (6th June 1936 to 5th June 1937). 1938. 9. Annual Report of Canadian Seed Growers' Association for 1936-37. 10. Sierra Leone Annual Report of Agri. Dept. for 1937. 11. South Australia Report of Minister of Agriculture for the year ending 30th June, 1938. 12. Fifteenth Annual Report of Arkansas A. E. S. for fiscal year ending June 1938. 13. 24th Annual Report of Oklahoma A. E. S. for the year 1937. 14. Puerto Rice Experiment Station Annual Report for 1937.

C. New Periodicals.

1. Rural Electrification and Electro Farming. 2. Food Manufacture.